# Announcements

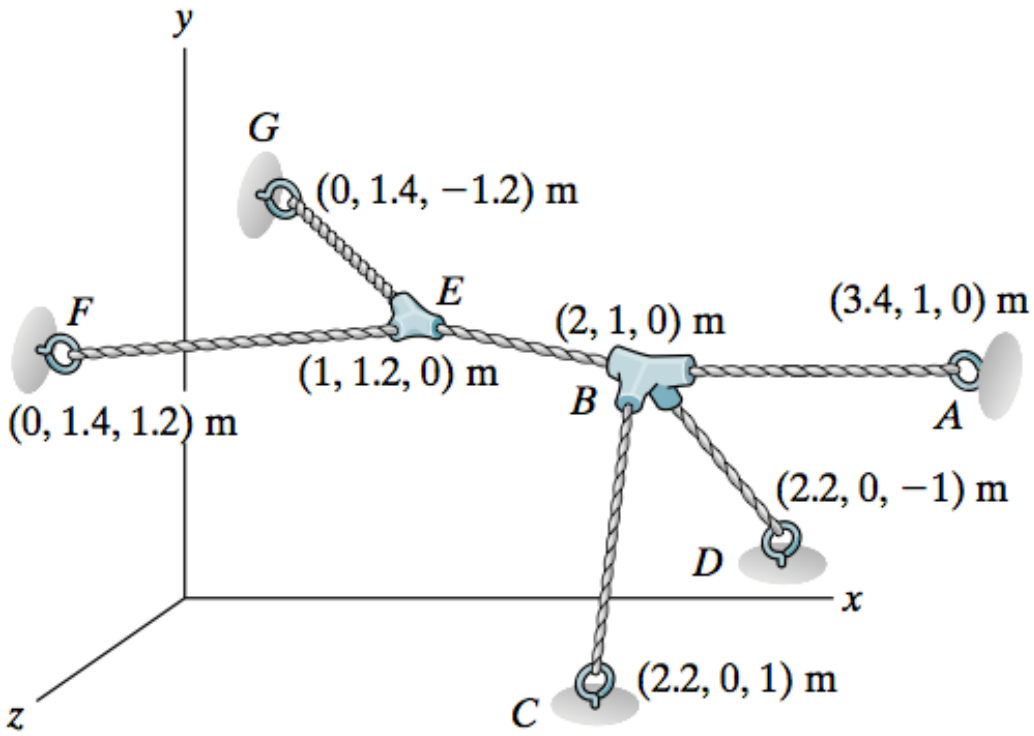
- Morning Office Hours: Mon/Wed, 9–10am in MEB 220H
- Quiz 2 sign-ups are now open
  - The scope of the exam will cover up to the end of today's lecture (Lecture 7)
  - Same format as Quiz 1

❑ Upcoming deadlines:

- Thursday (9/14)
  - ME HW5
- Tuesday (9/19)
  - PL HW6
- Due next week
  - Writing Assignment 1

# Recap

- Equilibrium of a particle in 2D and 3D
- Equilibrium of a system of particles
- Free body diagram
- Equation of equilibrium

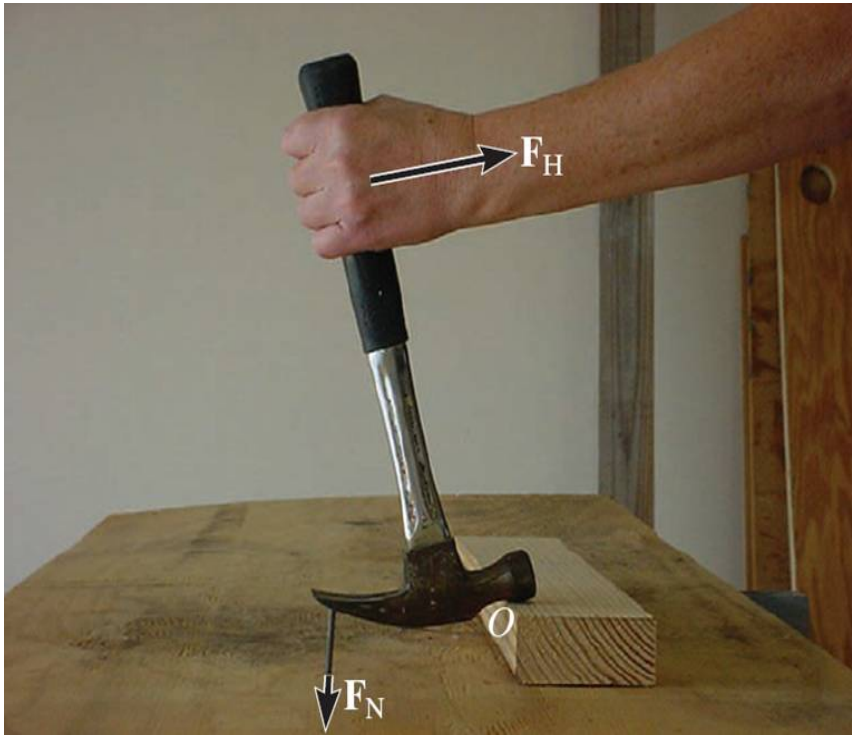


# Chapter 4: Force System Resultants

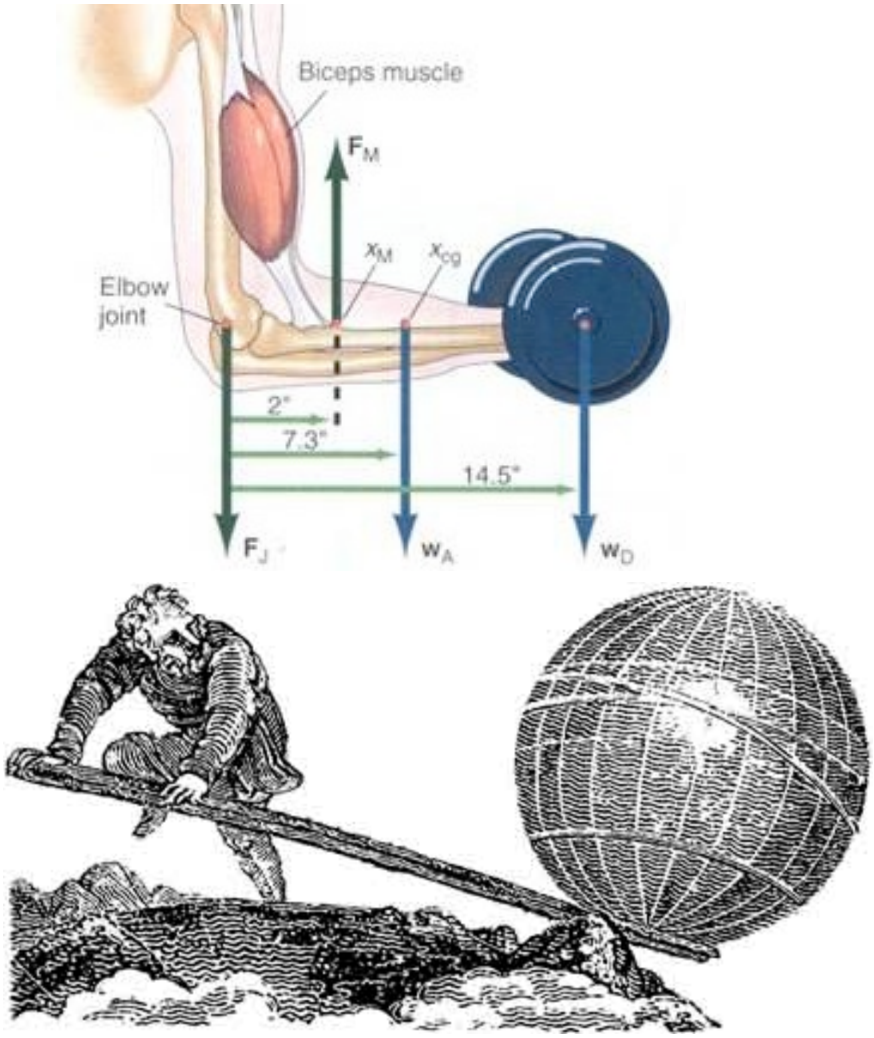
# Goals and Objectives

- Discuss the concept of the moment of a force and show how to calculate it in two and three dimensions
- How to find the moment about a specified axis
- Define the moment of a couple
- Finding equivalence force and moment systems
- Reduction of distributed loading

# Applications

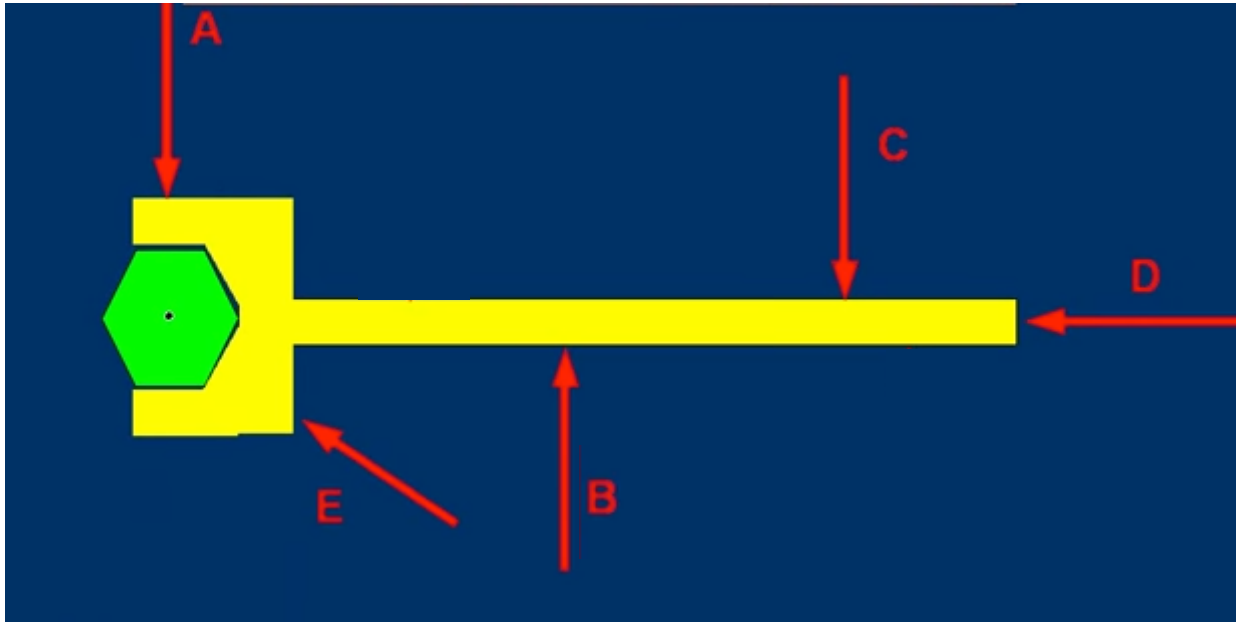



Carpenters often use a hammer in this way to pull a stubborn nail. Through what sort of action does the force $F_H$ at the handle pull the nail? How can you mathematically model the effect of force $F_H$ at point O?



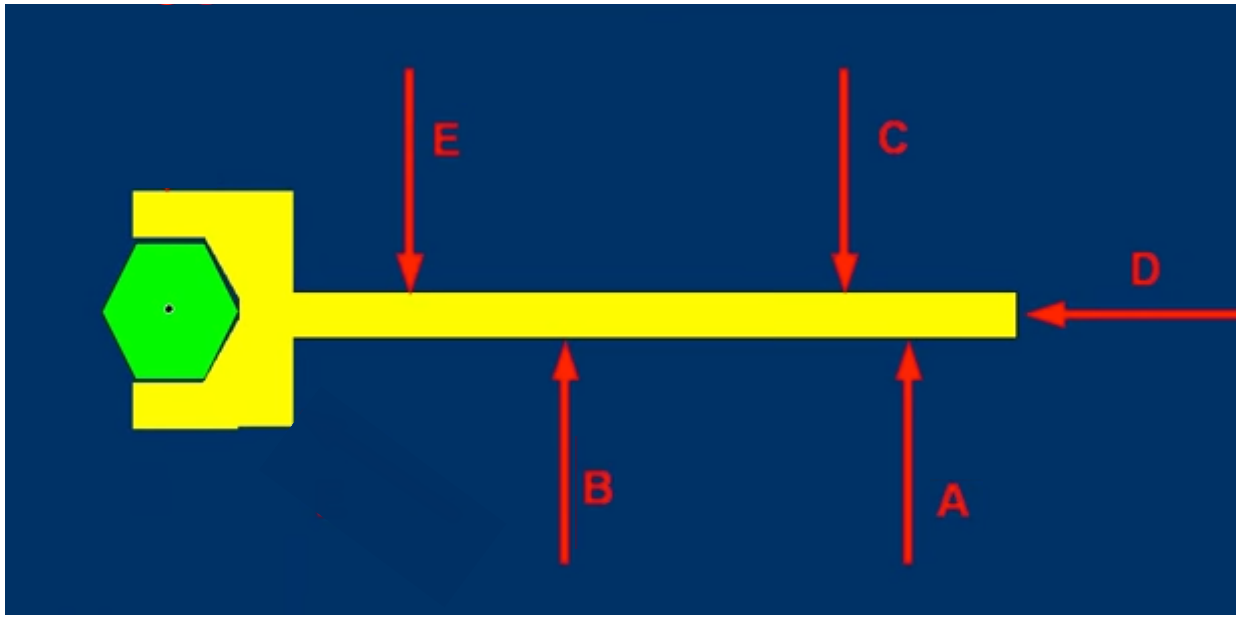

**Moment** 1.a very brief period of time. An Exact point in time. 2. importance. 3. A turning Effect produced by a force acting at a distance on An object.

# Moment of a Force




Which force(s) have NO turning effect?

# Moment of a Force

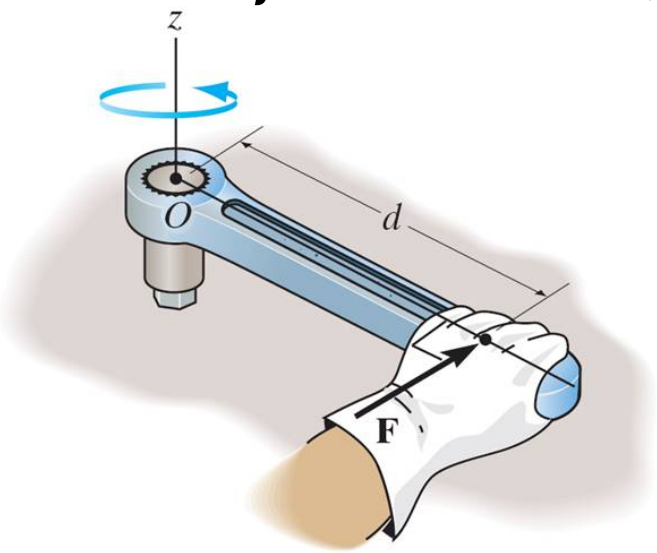



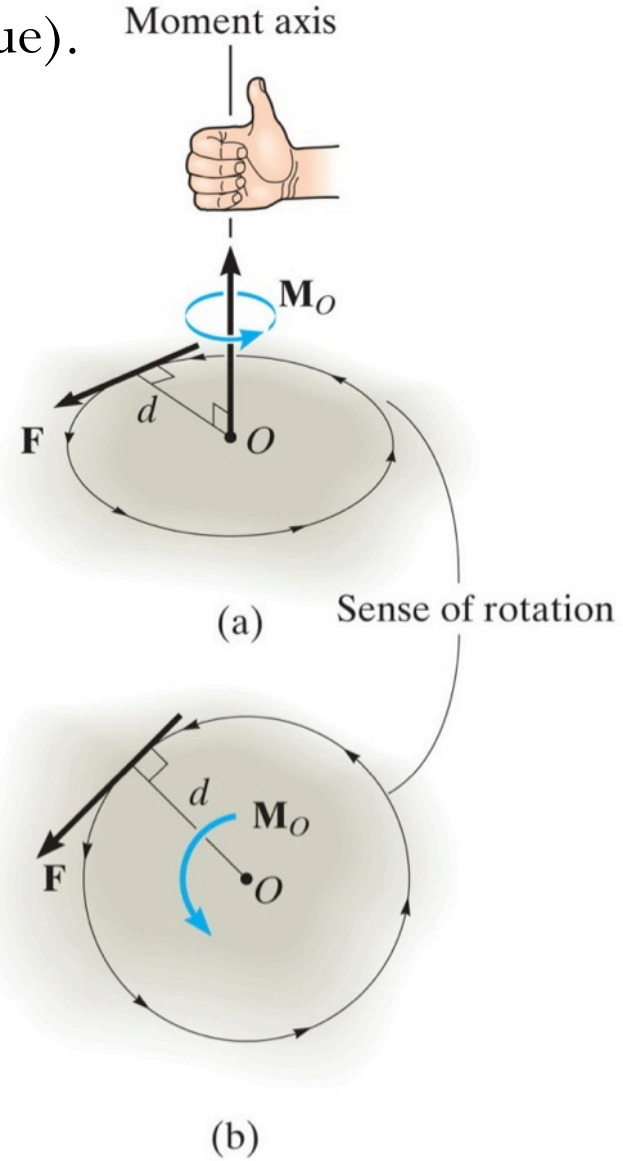

1) Which force(s) yields a "tighty" effect?

2) Which force(s) yields a "loosey" effect?

# Moment of a force – scalar formulation

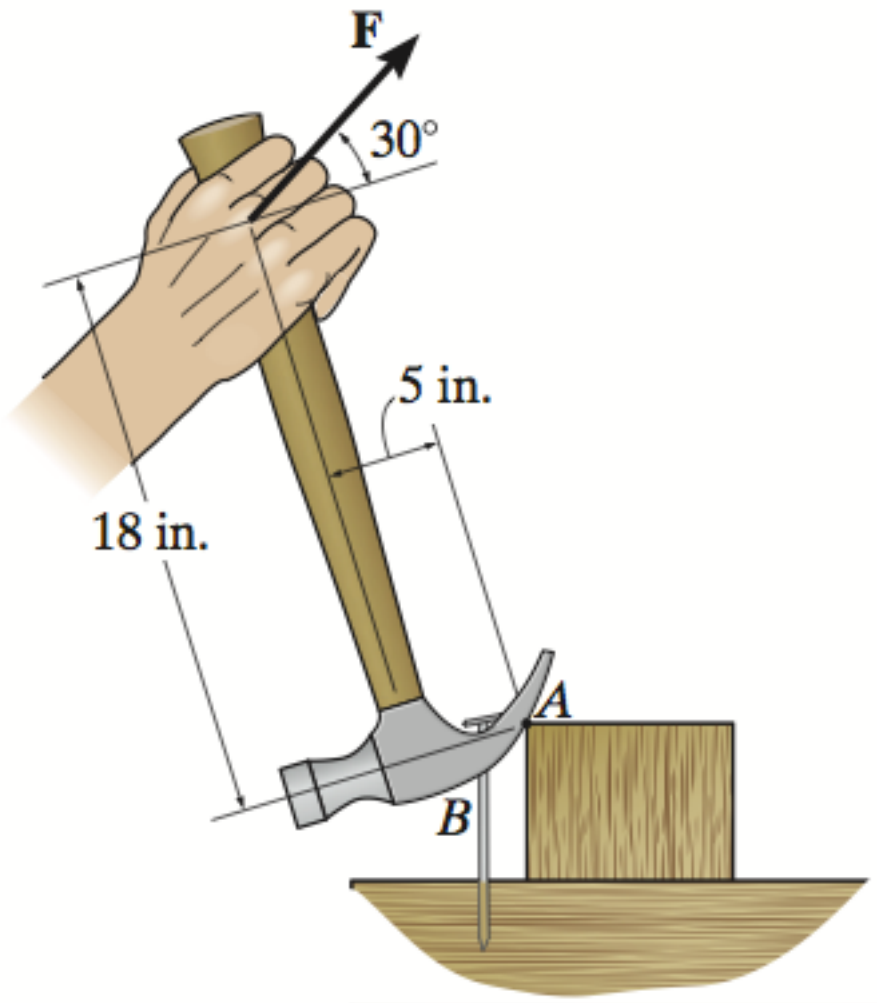
The **moment of a force about a point** provides a measure of the **tendency for rotation** (sometimes called a torque).



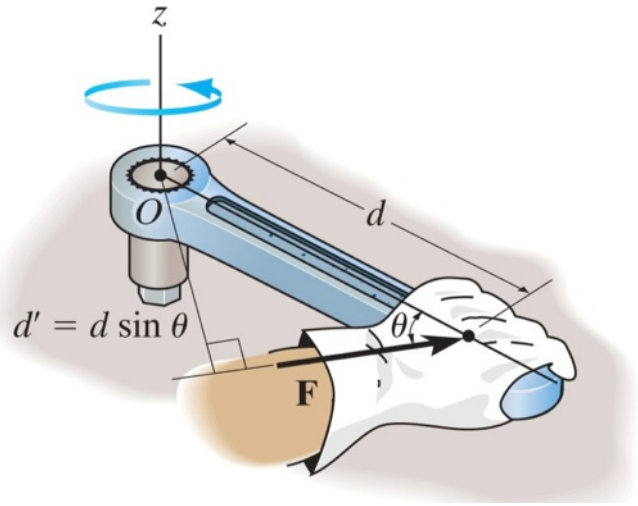
# Example – Scalar Formulation

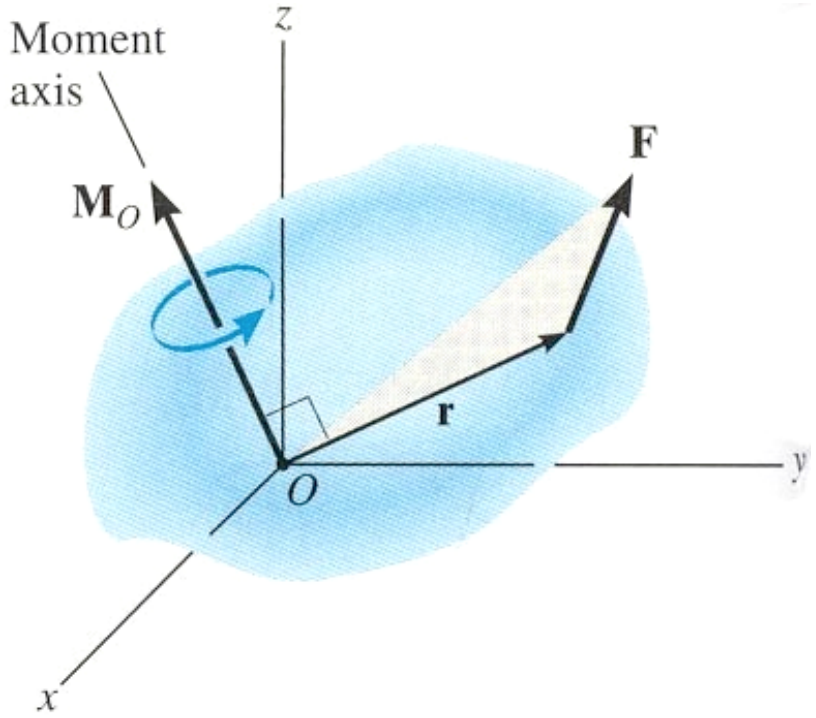
Determine the moment of this force about the point *A* as a function of **F**.



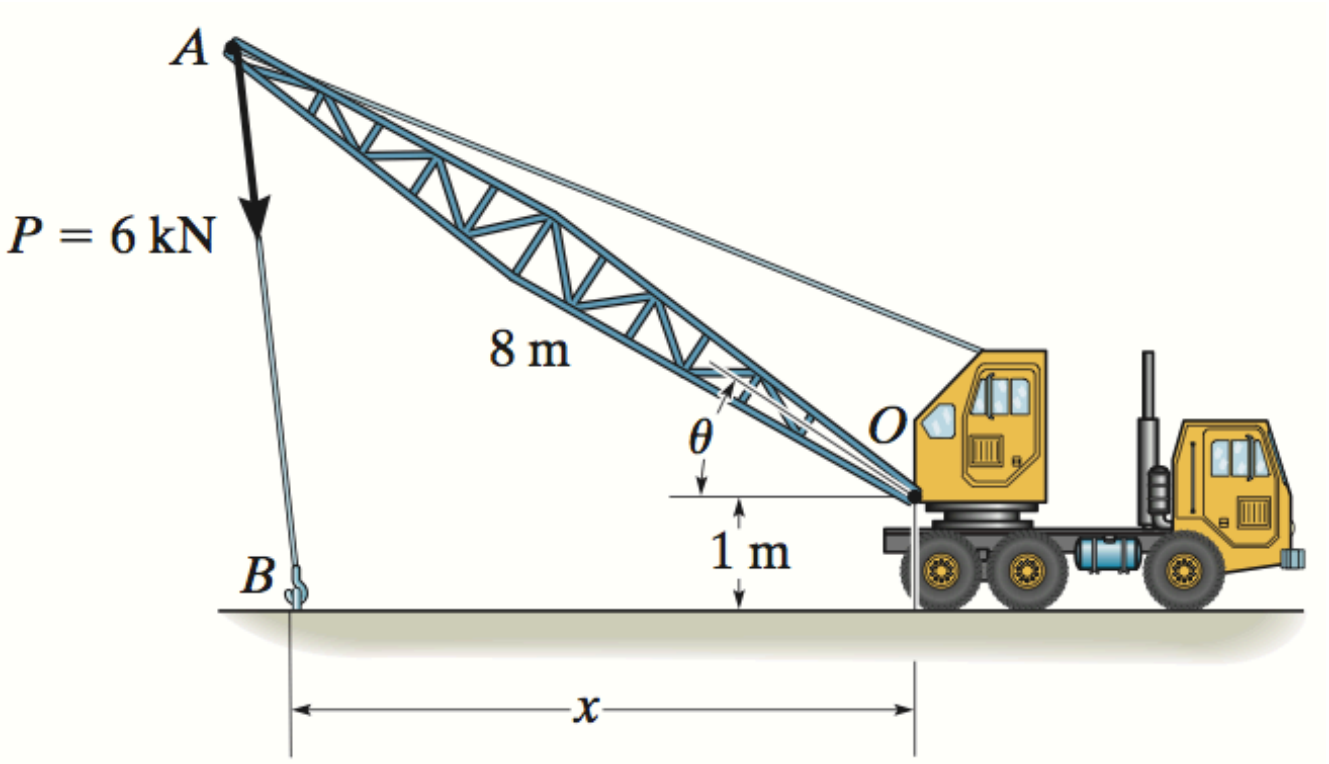
# Moment of a force – vector formulation

The moment of a force **F** about point **O**, or actually about the moment axis passing through O and perpendicular to the plane containing **O** and **F**, can be expressed using the cross (vector) product, namely:



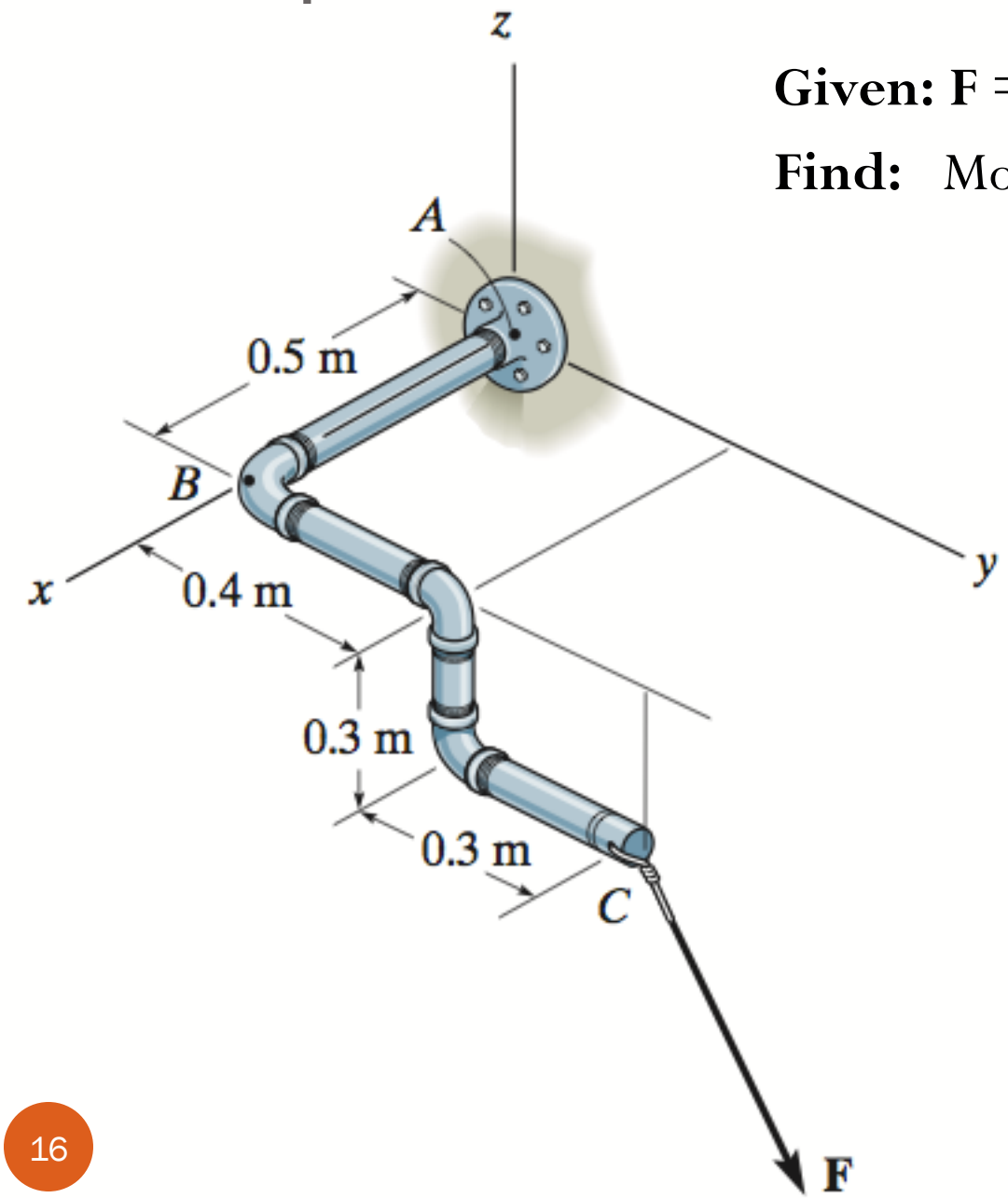
# Example – Vector Formulation




**Given:** The angle $\theta = 30°$ and $x = 10$ m.

**Find:** The moment by **P** about point O.

# Example – Vector Formulation




**Given:** $\mathbf{F} = \{600\mathbf{i} + 800\mathbf{j} - 500\mathbf{k}\}$ N

**Find:** Moment of the force about point *B*.

# Moment about a Specific Axis

Remember, the component of a vector, **A**, along the direction of another, **B**, can be determined using the dot product: